

Environmental Monitoring

General Sampling Procedures and
Quality Control





Objectives

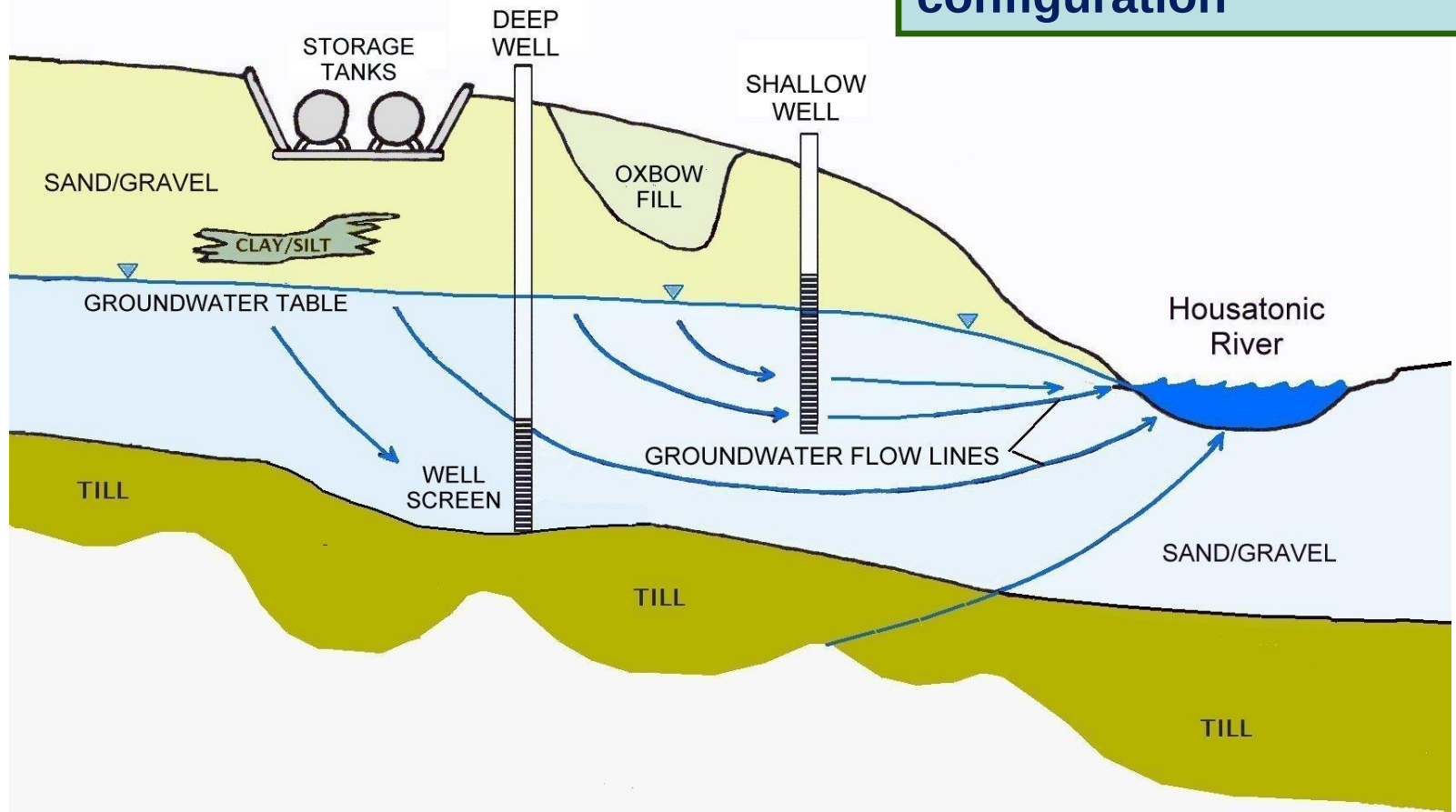
- Provide a Basic Understanding of:
 - Groundwater Occurrence
 - Collecting Representative Samples
 - Sampling Methods & Equipment
 - Sampling Procedures
 - Record Keeping
 - Best Practices
 - Quality Control





Generalized Groundwater Flow Diagram

Typical well installation configuration





Overall Sampling Goal

- Collect a “Representative Sample”
 - Reflects the actual chemistry in the formation near the well screen.
 - Is not measurably altered by:
 - Well Purging
 - Sample Collection
 - Foreign Material
 - Bottle Handling





Sampling Requires Teamwork

- Sampling Team:
- Site Representative
 - Primary Point of Contact
 - Provide current controlling documents
- Sampler/Project Manager
 - Knows Sampling Requirements
 - Collects Representative Samples
- Analytical Laboratory
 - Technical Resource





Controlling Documents

- Site Permit
- Site-Specific Sampling Plans
- Regulations
- Agency Guidance
- Other Specific Communication

Samplers must verify that they are following the most current versions





Controlling Document Content

- Sampling Points
- Sampling Order
- Parameters
- Methods
- Procedures
- Schedule

**If any of this information is missing –
ASK FOR IT!**





PURGING & SAMPLING EQUIPMENT



Dedicated vs. Non-Dedicated

- Dedicated
 - Stays in Well
 - No Decontamination
 - Reduces Sampling Time
 - Preferred for Long-Term Monitoring
- Non-Dedicated
 - Used in Different Wells
 - Must be Decontaminated
 - Increase Sampling Time
 - Potential for Cross Contamination
 - Preferred for Short-Duration Monitoring

Dedicated Sampling Equipment Provides Highest Level of QC but may Increase Costs



Purging and Sampling Equipment

Commonly Used Equipment

- Bladder Pumps
- Submersible Pumps
- Dedicated or Disposable Bailers





Purging and Sampling Equipment

Purging Equipment can Bias Samples:

- VOC Loss
- Turbidity
- Geochemical Changes

Be aware of equipment operations and how it may affect samples.

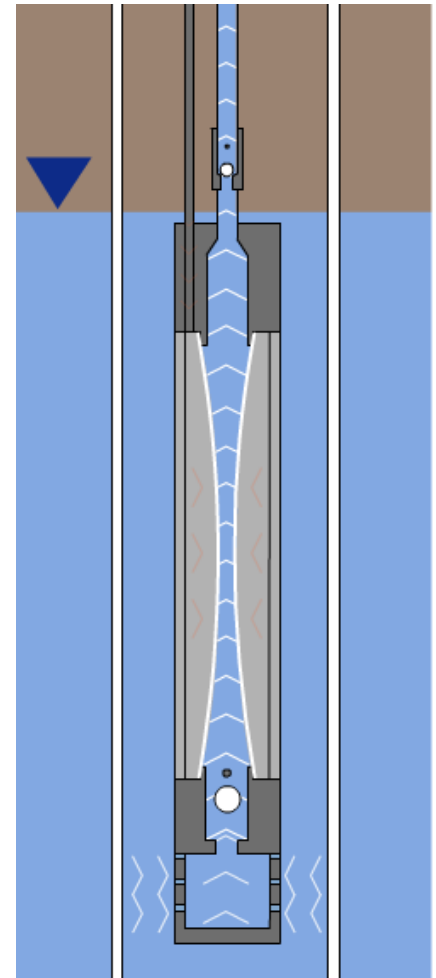




Bladder Pumps

- Typically Dedicated to a Well
- Uses Compressed Air to Constrict a Bladder
- Interior Bladder fills with Water
- Compressed Air Squeezes the Bladder Forcing Water out the Discharge Line
- Flow is Adjustable by Changing the Air Input and Discharge Frequency

Favored for long-term monitoring projects and low-flow sampling.

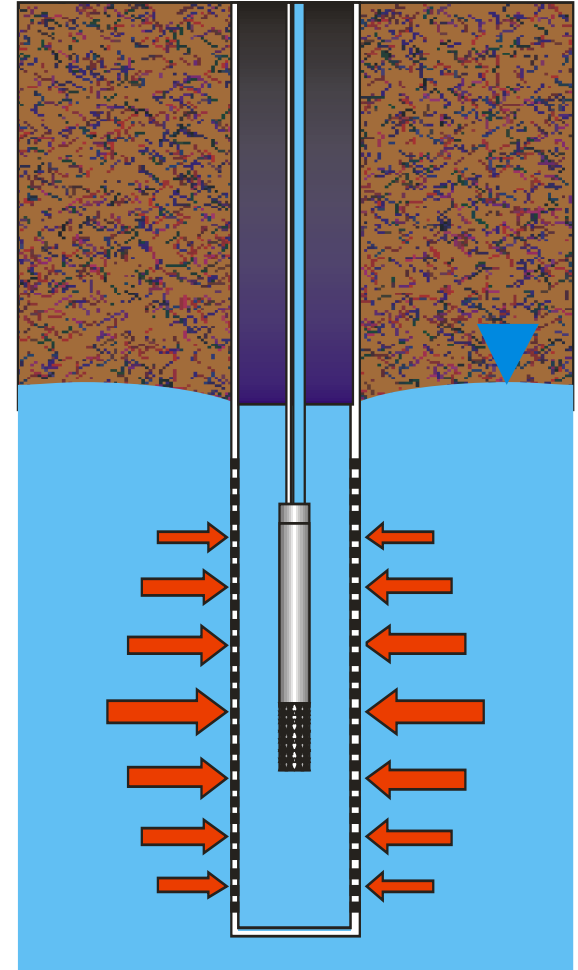




Bladder Pumps

- Pros:
 - Prevent Air From Contacting Water
 - Minimize Drawdown and Turbidity
 - Wide Range of Flow Adjustment
 - Laminar Flow Into Screen
 - Controlled Discharge
- Cons:
 - Expensive
 - Compressed Air Source
 - Generally Not Portable

Manufacturers now producing smaller more portable devices





Electric Submersible Pumps

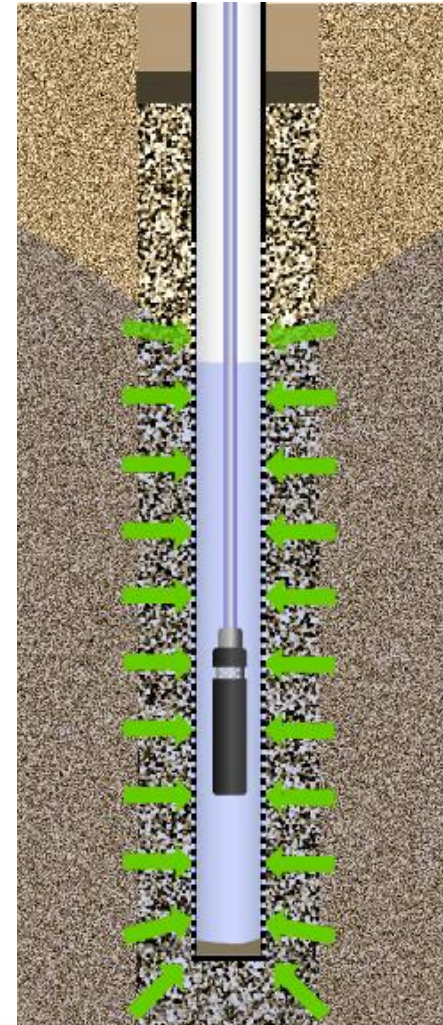
- Dedicated or non-dedicated
- Electric motor turns impeller
- Pump lifts water through discharge
- Water flow through pump cools motor
- Flow controlled by restricting discharge
 - Newer models use motor control





Electric Submersible Pumps

- Pros:
 - Fast purge
 - Inexpensive
 - Portable
- Cons:
 - Flow Adjustment can Build up Heat
 - Stray Voltage
 - Decontamination
 - Potential Overpumping





Bailers

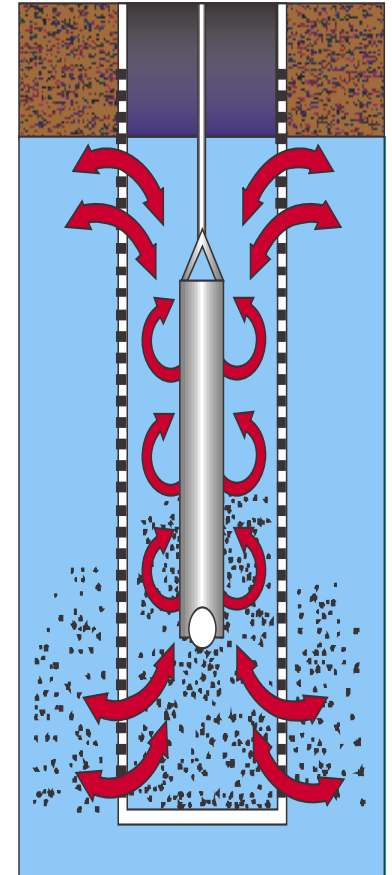
- Dedicated, non-dedicated or disposal
- Hollow tube with ball check-valve at base
- Various material
 - Stainless steel
 - Teflon
 - PVC
- Cord affixed to top
- Repeatedly lowered into well
 - Submerged and allowed to fill
 - Raised up to remove water





Bailers

- Pros:
 - Inexpensive
 - Portable
 - Simple
- Cons:
 - Slow & Inefficient
 - Aeration in well
 - Turbulence
 - Turbidity
 - Decontamination
 - Handling & Bailer Cord
 - Loss down well



Always use new bailer cord



Purging & Sampling Equipment-Review

- Various Purge and Sample Methods Available
- Each has Strengths and Weaknesses
- Dedicated Systems Preferred
- Consider:
 - Budget
 - Long-term Needs
 - Site-Specific Conditions
 - Data Quality Requirements





WELL CONDITION INSPECTION



Well Condition Inspection

- Sampler Responsibilities:
 - Document the condition of each well
 - Recognize when not to sample
 - Communicate issues

Samplers are the eyes and ears of the project team.





Well Condition Inspection

- Identify conditions such as:
 - Missing locks, labels, or weep holes
 - Damaged casing or concrete pad,
 - Inoperable equipment,
 - Excessive vegetation growth
- Damaged well or pump
- Evidence of tampering
- Strong/unusual odors
- Evidence of surface spills
- Excessive turbidity
- Any other maintenance need





If a well is not sampled...

- Complete a Field Information Form (FIF)
 - Reason well not sampled
 - Communications
 - Names
 - Dates
 - Authorizing representative

FIELD	
Final Field Readings are required (i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State Permit Site)	
Sample Appearance: _____ Odor: _____ Color: _____ Other: _____	
Weather Conditions (required daily, or as conditions change): _____ Direction/Speed: _____ Outlook: _____ Precipitation: Y or N	
FIELD COMMENTS	Specific Comments (including purge/well volume calculations if required): <u>Evidence of Tampering.</u>
	<u>Lock broken off & strong gasoline odor from</u>
	<u>Well. Called WM Rep (Mary Smith, Site</u>
	<u>Engineer), @ 1330. Instructed by Jeff</u>
	<u>Shanks, WM GP Director not to sample</u>
	<u>@ 1545 on 8/8/09.</u>
I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):	
<u>8/8/09</u>	<u>Joe Elliot</u>
Date	Name
	<u>Joe Elliot</u>
	Signature
	<u>DL Sampling SOC.</u>
	Company
DISTRIBUTION: WHITE-ORIGINAL - Stays with Sample, YELLOW - Returned to Client, PINK - Field Copy	



Well Condition Inspection





PURGING & SAMPLING METHODS



Purging & Sampling Methods

- Three principal methods:
 - Low Flow
 - Traditional Purging
 - Low-Yielding Well
 - Complete Evacuation
 - Minimal Purge





Purging & Sampling Methods

Low Flow Sampling

- Purging volume is based on field parameter stabilization
- The flow rate must be low enough to:
 - Induce lateral flow from the formation
 - Minimize:
 - Drawdown
 - Turbidity





Field Parameter Stabilization

- Follow site-specific requirements
- Measure every 3 to 5 minutes**
 - After water level has stabilized
- Achieved when all parameters have 3 successive readings meeting the stabilization criteria
- General stabilization criteria:
 - pH: ± 0.2 Standard Units
 - Conductivity: $\pm 5\%$
 - Dissolved Oxygen: $\pm 10\%$ or 0.2 Mg/L
 - Turbidity: $\pm 10\%$

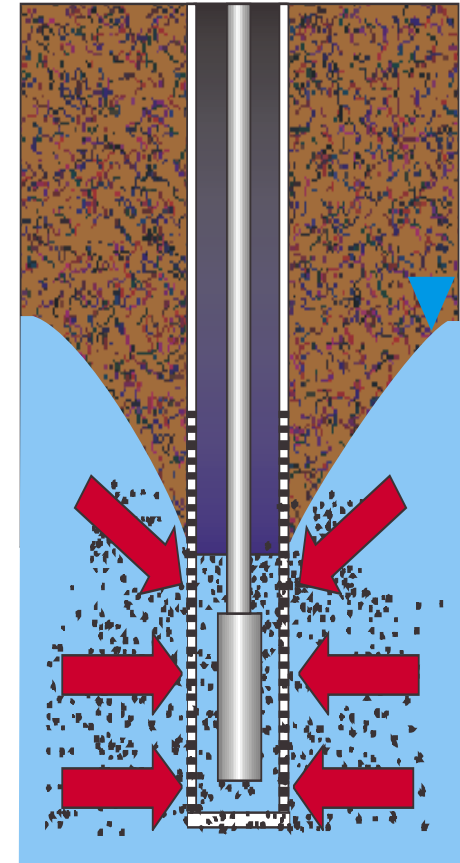
**** Frequency of measurement may be adjusted based on flow. Slow producing wells may need more time between readings.**



Traditional Purging Method

- Calculate volume of water in the well
- Purge a minimum of 3 to 5 well volumes
 - Record water levels during purging
 - Do not pump well dry
 - Avoid excessive drawdown
 - - Never expose the
 - pump intake.

Attempt to stabilize parameters with minimal drawdown even when doing traditional purge.





Low-Yield Well Methods

- Slow recharging well where purging less than 0.5 L/min:
 - Dewater the well, and
 - Field parameters do not stabilize
- Two sampling approaches
 - Complete evacuation
 - Purge well dry
 - Sample after recovery
 - Minimal purge
 - Dedicated Sampling equipment required
 - Do not purge well
 - Sample water in the well screen area

Neither approach is optimal



FIELD MEASUREMENTS



Field Measurements

Groundwater Levels

- Groundwater levels must be recorded:
 - Prior to and during purging
 - With a decontaminated device
 - Accurate to 0.01 foot
 - Referenced to the top-of-casing
- Be aware of site-specific conditions
 - Extraction wells



Record groundwater levels on the same day.



Field Measurements

Field Parameters

- Recorded:
 - During purging - Stabilization
 - When collecting lab samples - Final
- Common field parameters
 - pH, Temperature, Specific conductance
- Recommended:
 - Dissolved oxygen, Turbidity, and Oxidation reduction potential (Eh/ORP)
- Document
 - Field Book
 - Field Information Form

**Field readings are to be taken ASAP
– pH is REQUIRED within 15
minutes... this is far too long.**



Field Measurements

- In-line flow cell:
 - Real-time data
 - Isolates sample from air
 - Provides more consistent data

- Hand-held instruments:
 - Some parameters may be affected by
 - Temperature changes
 - Atmosphere
 - Record as soon as possible



Disconnect in-line meters before sample collection



Calibration of Field Meters

- Calibrate Meters Before Each Event
- Check Calibration Solution Expiration Date
- Follow Procedures in the User's Manual
- Document Calibration in a Calibration Log or on the Field Information Form
 - Date
 - Time
 - Final Calibration Readings

If calibration is not documented, results for entire sample event are subject to challenge.





Unusual or Inconsistent Measurements

- pH: +/- 1 unit
- pH: <5 or >9
- Specific conductance: +/- 25%
- Turbidity: Significant change in clarity
- What you should do:
 - Recalibrate meters
 - Perform additional purging



These can alert samplers to calibration or well problem.



Turbidity

- Goal: <50 NTU
- NTU 50 – 500: Attempt to reduce to <50 NTU
 - Perform additional purging
 - Reduce purge rate
 - Document on FIF
- NTU >500:
 - Notify site or Project Manager
 - Do not sample unless authorized



Groundwater is not turbid – turbid samples are not representative. Well may be inadequately developed.



Quality Control



Quality Assurance & Quality Control

- Quality Assurance & Quality Control (QA/QC):
 - Assures sample integrity
 - Avoids sample contamination
 - Documents sample collection
 - Is practiced throughout sampling event





Gloves

- Powder-Free Latex or Nitrile Gloves
 - Powers can affect samples
- Change Gloves Upon:
 - Arriving at a new sample location
 - Touching equipment or surfaces

Gloves are meant to protect the sample from YOU!





Decontamination

Decontaminate:

- Non-Dedicated Sampling Equipment
- Use Non-Phosphate Containing Detergent
 - Alconox
 - Liquinox
- Prior to Each Use
- Follow Plans for Containment and Disposal



Keep distilled or deionized water on hand



Who is using proper QC?





Quality Control Samples

- Trip Blanks
- Field Blanks
- Equipment Blanks
- Duplicate Samples

Detect contaminants introduced in the field, in transit, in bottle preparation, or in the laboratory

Confirm analytical results

Failure to collect required quality control samples can result in a violation notice



SAMPLE COLLECTION & HANDLING



Filtration

- Filtration can affect sample chemistry
- Use in-line cartridge filters
 - Typically 0.45 micron
- Condition before collecting samples
 - Allow 2 filter volumes to pass





Flow Rate & Bottle Filling

- After purging -- Reduce flow rate for filling bottles
- Avoid overfilling and preservative loss
 - Can compromise results
- Place caps upright on clean surface
- Minimize agitation/aeration
- Further reduce flow for filling VOAs



If sampling order not specified sample VOCs last so that flow rate may be reduced



Sample Collection and Handling

- Clearly Label Samples
 - Date/Time
 - Location
 - Personnel
 - Parameters

A sample label form with a cloud icon in the top left corner. The form contains the following fields:

Date:	Sample number:
Location:	Sample time:
Personnel:	Note:
Organisation:	
Sample type:	

TestAmerica Laboratories, Inc.

Barcode: R S F 0 8 9 6 - 0 1 A

Waste Management, Inc. - Burnsville, MN

Project: Quarterly MSW Leach (4,10) - NY5A5836.4AE04299

Sample: MSW LEACH

Container: 1 L Plastic Unpreserved

Date: _____ Time: _____

Some labs use
barcodes to track
samples



Sample Collection and Handling

- Immediately Place Samples in an Ice-Packed Cooler
 - On hand when sampling
 - Use water ice
 - Blue ice is not as effective



Use water ice. Blue or chemical ice is not recommended



Documentation

- Use Field Information Form (FIF)
- Complete FIF for Each Sample Location
- Submit Original FIF to the Laboratory with Samples
- Record
 - Date
 - Time
 - Sample Location
 - Sample ID
 - Field Measurements
 - Sampler Signature



Documents that you sampled the location following proper and required procedures



What If...

- The sample location is dry, destroyed or inaccessible?

Call someone! You are the eyes and ears for the project manager and client.

- What if you cannot or do not sample a required location?

Fill out a Field Information Form anyway. It proves you did not simply forget to sample and it documents the reason why a sample was not collected. Record relevant names and instructions.



Post-Sampling Procedures



Post Sampling - Overview

- Completing Chain-of-Custody Forms
- Packaging Coolers
- Delivering Samples to the Laboratory





Chain-of-Custody (COC) Form

- Documents the continuous control of the sample from collection to analysis.
- Remains with the sample until analysis is performed
- Must be included in the cooler with the samples.
 - Shipping agents (such as FedEx) do not sign the COC.
 - Shipping receipt must be retained as part of the record.
- A complete COC is required for each cooler.

Missing or incomplete COC can result in regulatory or legal challenge of the sample event.



Sample Coolers



Cooler With Field Forms and Water Ice



Cooler with Custody Seal

Samples must be no warmer than 4 degrees Centigrade upon laboratory receipt



Shipping or Delivery to Laboratory

- Some laboratories provide shipping
- Coordinate with the shipper to avoid delays
- Shippers will not deliver coolers leaking water

Coordinate the delivery of short-hold-time samples with the laboratory





Common Errors

- Chain-of-Custody
 - Incomplete
 - Missing
- Samples received > 4 degrees Centigrade
- Broken Sample Containers





Summary

Key Actionable Take-Aways

- You are Part of a Team. Communication is Key
- Know the Sampling Requirements
- Inspect and Document Well Conditions
- Avoid Turbidity and Excessive Drawdown
- Document all Activities
- Use Proper Quality Control Throughout Sampling



Thank You

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